INTERNATIONAL PATENT COOPERATION TREATY

From the THE INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

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PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Rule 71.1 PCT)

	Date of mailing *(Day/month/year)* 26.04.2005
Applicant's or attorney's file number S40095PCT	**IMPORTANT NOTIFICATION**

International application number	Date of international filing *(Day/month/year)*	Priority dates *(Day/month/year)*
PCT/DE2004/000452	09.03.2004	21.03.2003

Applicant
SAUERESSIG GMBH + CO et al.

1. The applicant is hereby notified that the International Preliminary Examining Authority has transmitted the requested international preliminary report on patentability and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all The elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (excluding the annexes) and transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date(or later in some Offices) (Article 39(1)) (see also the reminder sent by the international Bureaus with form PCT/IB/301).

Where a translation of the international application must be furnished to an Office that translation must contain a translation of any annexes of the international preliminary report on patentability. It is the responsibility of the applicant to prepare and furnish such translation directly to each elected Office concerned.

Additional details regarding deadlines and requirements of the elected Offices can be found in volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State (...) may apply additional or different criteria for the purposes of deciding whether, in that state, the claimed invention is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and address of the international preliminary examining authority	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Telex 523656 epmu d Fax. + 49 89 2399 – 4465	Fernández Gomez, L Tel. +49 89 2399-7449

Form PCT/IPEA/416 (January 2004)

INTERNATIONAL PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

Applicant's or agent's file number S400095PCT	FOR FURTHER ACTION See form PCT/IPEA/416	
International file number PCT/DE2004/000452	International filing date (Day/Month/Year) 09.03.2004	Priority date (Day/Month/Day) 21.03.2003
International patent classification (IPC) or national classification and IPC D21H25/06		
Applicant SAUERESSIG GMBH + CO. et al.		

1. This report is the international preliminary examination report established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant in accordance with article 36.

2. This REPORT consists of 6 pages, including this cover page.

3. Furthermore, this report is also accompanied by ANNEXES, comprising:

   a. X (*Sent to the applicant and the International Bureau*) a total of 7 pages, as follows:

      X of the description, claims and/or drawings which have been amended and are the basis of this report and/or pages containing rectifications authorized by this Authority (see rule 70.16 and section 607 of the Administrative Instructions).

      X pages which supersede earlier pages, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of box no. 1 and the supplemental box.

   b. (*only sent to the International Bureau*) a total of (indicate type an number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

X	Box no. I	Basis of the report
☐	Box no. II	Priority
☐	Box. no. III	Non-establishment of opinion with regard to novelty, inventive step or industrial applicability;
☐	Box no. IV	Lack of unity of invention
X	Box no. V	Reasoned statement under article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box no. VI	Certain documents cited
☐	Box no. VII	Certain defects in the international application
X	Box no. VIII	Certain observations on the international application

Date of submission of the demand 02.10.2004	Date of completion of this report 26.04.2005
Name and mailing address of the IPEA/ European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Telex 523656 epmu d Fax: +49 89 2389 - 4465	Authorized Officer Nestby, K (Seal of EPO) Tel. No. +49 89 2399-8625

INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

International file number
PCT/DE2004/000452

Box no. I **Basis of the report**

1. With regard to the **language,** this report is based on the International application in the language in which it was filed unless otherwise indicated.

   ☐ The report is based on a translation from the original language into the following language which is the language of translation furnished for the purposes of:
   ☐ international search (rules 12.3(a) and 23.1(b))
   ☐ publication of the international application (rule 12.4(a))
   ☐ international preliminary examination (rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application this report is based on (*replacement pages, which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report).*

   Description, pages:

4-6, 8, 9	as originally filed
1, 2, 2a, 3, 7	received by this Authority on 19.01.2005 with letter dated 18.01.2005

   Patent claims no.

1-9	received by this Authority on 19.01.2005 with letter dated 18.01.2005

   ☐ a sequence listing and/or any related table(s) – see Supplementary Box relating to Sequence Listing

3. X The amendments have resulted in the cancellation of:

   ☐ the description, pages
   X claims no.: 6, 8, 13, 14
   ☐ the drawings, pages/figures
   ☐ the sequence listing *(specify)*
   ☐ any table(s) related to the sequence listing *(specify)*

4. X This report has been established as if (some of) the amendments annexed to this report and listed below had not been made since they have been considered to go beyond the disclosure as filed, as indicated in the Supplementary Box (rule 70.2(c)).

   ☐ the description, pages
   X the claims no.: 6
   ☐ the drawings, pages/figures
   ☐ the sequence listing *(specify)*
   ☐ any table(s) related to the sequence listing *(specify)*

   * *if item 4 applies, some or all of those pages may be marked "replaced".*

INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

International file number
PCT/DE2004/000452

Box no. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanation supporting such statement

1. Statement

Novelty (N)	Yes: Claims 1-9 No: Claims
Inventive Step:	Yes: Claims 1-9 No: Claims
Industrial Applicability:	Yes: Claims 1-9 No:

2. Citations and explanations (Rule 70.7):

Please refer to the annex

Box no. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description are made:

Please refer to the annex

Regarding Box no. I
Basis of the report

1. Wave lengths of between 1000nm and 1000µm were originally **only disclosed for microwave radiation.** Please refer to claim 7 of the original claims which refers to claim 6 as well as the second paragraph on page 6 of the description.

   When this characteristic is deleted in the new claim 6, facts are introduced that go beyond the content comprised in the original version of the application. This constitutes a violation of article 19(2) and/or article 34(2)(b) of the PCT.

Regarding Box no. V

Reasoned statement with regard to novelty, inventive step and industrial applicability; citations and explanation supporting such statement

2. Please refer to the following documents:

   D1: EP-A-0 671 504
   D2: DE-A-196 39 491 (refer to column 3, lines 32-37)
   D3: EP-A-0 989 231

   Either D1 or D2 is deemed to be the closest prior art to the object of claim 1. These documents disclose a production method for an absorbing fiber product comprising a parent fiber product (waste paper or paper) which is treated ("wetted") with a fluid medium (water, water vapor) and the fluid medium is "rapidly" evaporated by irradiation.

   The object of claim 1 is thus distinctive from the well-known methods in the elements of the characteristic parts of the claims.

The object of claim 1 is thus novel (article 33(2) PCT).

2.1 The object of the present invention therefore should be to loosen the fiber structure without destroying it. Refer to page 6 of the description.

Claim 1 of the present application comprises a solution to this object and represents an inventive step for the following reasons (article 33(3) PCT):

Although the other well-known methods also result in some loosening of the fiber structure the ultimate goal of the methods is different, namely either "bursting of the structure of a solid" (D2, column 1, lines 59-68) or "method for the production of foam material" (D1).
The object of D3 is to set the moisture profile of a drying paper or tissue web using microwaves.

D2 mentions "microwaves in a power range of between 10 W and 50 kW". In neither of the documents D1, D3 is the power density of the radiation described. In the description of the present application (refer to the last line on page 6 which continues on page 7) it is claimed that the power density (of claim 1) is higher than conventional microwaves and leads to an almost explosive evaporation of the fluid medium within the parent fiber product.

The person skilled in the art could thus not find a solution to the object of the present invention on the basis of prior art without relying on an inventive step.

2.2 Claims 2 to 9 are dependent on claim 1 and thus also fulfill the requirements of the PCT with regard to novelty and inventive step.

Regarding Box no. VIII

Certain observations on the international application

3. The words "in such a way" in the last line of the preamble of claim 1 appear to be superfluous.

Production method for an absorbent fiber product ~~and corresponding absorbent fiber product~~

The invention relates to a production method for an absorbent fiber product, according to which a parent fiber product is prepared comprising fibers that on the one hand lie at a statistical distance from one another and on the other hand make contact with one another at contact points. ~~The invention also relates to a corresponding absorbent fiber product produced in accordance with this method~~.

Fiber products such as hygiene products or so called non-woven products like paper used for paper toweling, toilet paper and tissues etc. are very absorbent. The absorbency capability of a fiber product determines its quality and value. The prevailing types of fiber used are, for example, chemical wood pulp.

The absorbency capability of a fiber product is essentially determined by the unrestricted volume achieved by such a fiber product. In this connection, the arrangement of the fibers which, on the one hand, lie at a statistical distance from one another and, on the other hand, make contact with one another at contact points, is of importance. The interstitial space between the fibers can absorb liquids of all kinds. The absorbency capability of the fiber itself also plays a role.

Other well-known methods for the production of absorbent fiber products concentrate on producing a fiber product with absorbency capabilities that rely on the above mentioned arrangement of the fibers as well as the characteristics of the fibers themselves during the production process. Up until now, no additional means exist that can increase the absorbency capability of fiber products thus taking into consideration the specific characteristics of fiber products.

DE 196 39 491 C2 describes the enlargement of the surface of particles such as granulate or powder, for example, concrete fragments so that, at least to a limited extent, particles

that absorb liquid are subjected to a liquid or its humid atmosphere until the liquid has penetrated at least into the surface area of the particle but preferably to the core. Subsequently, the liquid containing particles are radiated with microwaves until the penetrated liquid is rapidly evaporated and the particle structure bursts open. This method is mostly suitable for hard particle structures and the result of the method is burst particles as the liquid within the particle is evaporated.

As opposed to loose particles that lie next to each other, a fiber product consists of a conglomerate of fibers which because of their characteristics stick together and hold together the conglomerate as, for example, paper. On the one hand, the fibers lie at a statistical distance from one another and, on the other hand, make contact with one another at contact points.

The implementation of the above described method using fiber products of the type described above would render the fiber product unusable and would at the very least have detrimental drawbacks since the fiber structure and the conglomerate would be destroyed or burst in an uncontrolled manner. Furthermore, the intensive irradiation would thermally affect the fibers used in the fiber product and would thermally damage the fiber material which only appears to superficially increase absorbency. Lasting damage to the fiber would result in a rough paper product that would disintegrate easily when wet, which would render the fiber product less absorbent and virtually useless. No production method is known that tries to advantageously influence the absorbency capabilities of fiber products after production. A production method that would largely eliminate the unwanted thermal damage to the fiber material but that also would significantly increase absorbency of an absorbent fiber product is needed.

[In handwriting: Page 2a]

~~This object is achieved by the present invention which comprises a production method for an absorbent fiber product whereby the absorbency capabilities of a fiber product are improved compared to the initial absorbency capability of the parent fiber product.~~

EP 0 671 504 A1 relates to a method for the production of foam material from waste paper and the like which as a liquid, preferably, watery pulp is heat treated as the pulp is exposed to microwave radiation so that the paper pulp is expanded from the resulting steam and is left in a porous state.

EP 0 989 231 A2 relates to a method for setting the moisture profile of a drying fiber web whereby the fact that water absorbs more high frequencies and/or microwaves than dry paper or its fibers do, is taken advantage of.

In this connection the invention comprises the object of providing a production method for an absorbent fiber product whereby the absorbency capability of the absorbent fiber product is improved in comparison to the initial absorbency capability of the parent fiber product.

Furthermore, the present invention relates to an absorbent fiber product produced in accordance with this method.

The object of the present invention is achieved by means of a production method of the type described above where in accordance with the invention,

- the parent fiber product is treated with a fluid medium in such a way that the fibers are at least partially wetted and
- the fluid medium is rapidly evaporated by irradiation between the fibers, so that the evaporation pressure generated by the evaporating fluid medium has a kinematic effect on the fibers, which increases the distance between them.

In this connection, microwave radiation having a power density of between $10^3 W/mm^2$ and $10^6 W/mm^2$ is employed.

The invention is based on the observation that an initial absorbency capability of a parent fiber product within the scope of an ordinary production method is limited by the usual mechanical influences on the parent fiber product within the framework of the normal production process. The invention recognizes that the initial absorbency capability mainly is determined by the statistical distance between the fibers in the parent fiber product. The conclusion of the observations of the invention thus is that as the distance between the fibers is increased the initial absorbency capability is also greatly increased. To this end, the fibers are superficially wetted by the fluid medium. Thermal damage to the fibers themselves from the irradiation which would have significantly compromised the tear strength is avoided. However, the invention reveals that by exposing the surface of the fiber to a fluid medium and then to massive irradiation undesired influence on the fibers themselves is largely avoided. Therefore, the inventive method ensures that after at least partial wetting of the fibers the irradiation predominantly affects the fluid medium as the irradiation rapidly evaporates the fluid medium. In accordance with the inventive method, a sufficiently rapid evaporation of the fluid medium will generate such strong evaporation pressure or partial pressure that it

described kinematic effect on the parent fiber product, power densities of between 10^3W/mm² and 10^6 ~~Watt/mm²~~ ~~are preferable~~, when using pulsed or continuous microwave radiation or any other type of irradiation. Such power densities are greater than those used for conventional microwaves which reach between 10 and 100 ~~Watt/mm²~~. This difference in power density leads to an almost explosive evaporation of the fluid medium within the parent fiber product which then leads to the above described kinematic effect on the fibers. Such great power density can be achieved mainly by employing a high-performance irradiation source and corresponding precise focusing of the irradiation. These principles are valid for all types of irradiation. Microwave radiation is particularly suitable since absorption is high for the aqueous or vaporous forms of the fluid medium while it remains comparatively low for common fibers.

In a particularly advantageous embodiment of the proposed production method, an additional step provides for the control of the time period between, on the one hand, the wetting of the fibers as the parent fiber product is treated with the fluid medium and, on the other hand, the rapid evaporation of the fluid medium by irradiation. In this manner, the scope of a diffusion of the fluid medium is directed between and/or, if necessary, into the fibers. Depending on the type of vapor deposition and the type of vapor deposition medium used, this embodiment achieves, in addition to the kinetic effect between the fibers, a targeted influence of the fiber structure while avoiding causing inadvertent thermal damage to or the destruction of the fibers. As opposed to other well-known methods which comprise bursting particles, with the present embodiment, depending on which surface energy the fluid medium/vapor deposition medium has, it will bind exclusively to the fibers, wetting only the surface without penetrating them. If necessary, the fluid medium can also be permitted to diffuse into the fibers. Since this process is determined by well-known time frames the amount of fluid (vapor deposition) medium that binds to the fiber or is inside the fiber can be adjusted for exactly. In this manner, the specified time period ensures that the fibers are only wetted on the surface, or in other words, ensures that the fluid medium binds only to the surface of

Claims

1. Production method for an absorbent fiber product, according to which
   - a parent fiber product is prepared comprising fibers that, on the one hand, lie at a statistical distance from one another and, on the other hand, make contact with one another at contact points and

   - the parent fiber product is treated with a fluid medium in such a way that the fibers are at least partially wetted whereby the fluid medium is rapidly evaporated by irradiation between the fibers
   characterized by the fact that the irradiation applied to the fiber product has a power density of between $10^3 W/mm^2$ and $10^6 W/mm^2$ so that the evaporation pressure generated by the evaporating fluid medium has a kinematic effect on the fibers, which increases the distance between them.

2. Production method in accordance with claim 1 characterized by the fact that the parent fiber product is exposed to vapor deposition and/or vapor saturation by the fluid medium in the form of vapor.

3. Production method in accordance with claims 1 or 2 characterized by the fact that the parent fiber product is wetted or saturated by the fluid medium in the form of an emulsion.

4. Production method in accordance with one of claims 1 to 3 characterized by the fact that the fibers are homogeneously wetted.

5. Production method in accordance with one of claims 1 to 4 characterized by the fact that the kinematic effect on the fibers compacts them on the contact points.

6. Production method in accordance with claims 1 characterized by the fact that

the irradiation comprises wave lengths of between 1000nm and 1000µm.

7. Production method in accordance with claim 1 characterized by the fact that the exposure time is between 1µs and 1000ms.

8. Production method in accordance with one of claims 1 to 7 characterized by the fact that
in an additional process step the time period between, one the one hand, the wetting of the fibers with the fluid medium
and,
on the other hand, the rapid evaporation of the fluid medium
is adjusted in a targeted manner so the scope of a diffusion of the fluid medium is directed in between and/or into the fibers.

9. Production method in accordance with one of claims 1 to 8 characterized by the fact that in yet another process step, subsequent to the rapid evaporation of the fluid medium, the parent fiber product is treated with a fluid fixative.